From:	Peterson, Erik
To:	Peterson, Erik; Kubo, Teresa; Powers, David; Leinenbach, Peter; Henning, Alan; Winiecki, Eric
CC:	Baron, Adam
Sent:	1/30/2014 7:39:15 PM
Subject:	RE: quick turnaround....info on forest roads and sedimentation

One more recent reference, this compilation of Section 319 Nonpoint Source Program Success Stories from Idaho.

For example, "Removing Forest Roads and Restoring Streams Reduces Sediment in Yellowdog Creek"
http://www.deq.idaho.gov/media/1060953-north_fork_cda_river_implementation_success_stories_0913.pdf

Erik Peterson
Office of Ecosystems, Tribal and Public Affairs
EPA Region 10 - Seattle
peterson.erik@epa.gov
206-553-6382

From: Peterson, Erik
Sent: Wednesday, January 29, 2014 2:37 PM
To: Kubo, Teresa; Powers, David; Leinenbach, Peter; Henning, Alan; Winiecki, Eric
Cc: Baron, Adam
Subject: RE: quick turnaround....info on forest roads and sedimentation

Dave,

Teresa's references are excellent for establishing the connection between forest roads and sedimentation and turbidity in watersheds. Here are a few initial thoughts and references for linkages between forest roads and drinking water.

Research
There is widespread acceptance that upstream forest road related sedimentation can plug filters and other components of water treatment systems, and increase communities' water filtration costs. Research on this specific topic seems relatively hard to come by, but I think a more concerted search would be turn up useful studies. As an example of the type of finding which seems relevant, Moore and McCarl (1987) estimated that 77 % of downstream costs of erosion in Oregon's Willamette Valley were attributable to road maintenance (mainly ditch and culvert cleaning). 18% of these costs were incurred at water treatment plants. 5% of the costs were incurred for river dredging to maintain navigation.

Moore, Walter B.; McCarl, Bruce A. 1987. Off-site costs of soil erosion: a case study in the Williamette Valley. Western Journal of Agricultural Economics. 12(1): 42–49.

This synthesis may also be useful.
Dissmeyer, G.E., editor. 2000. Drinking water from forest and grasslands: A Synthesis of the Scientific Literature. United States Department of Agriculture, Forest Service. General Technical Report SRS-39.

TMDLs
I searched a few TMDL documents in Idaho for road related sediment impacts to drinking water and did not find anything. Information on roads and sediment generally is available in many of the sediment TMDLs, for example: Lochsa and North Fork Coeur d'Alene.

Municipal Water Systems
While I did not find any specific letters or operational information – such as closures or shutdowns – I can say there are a few geographic areas where the links between forest roads and drinking water are relatively more likely to be more direct. Consider, for example, that municipal water supply watersheds encompass 85% of the Rogue River National Forest and 94% of the Umpqua National Forest (http://www.fs.fed.us/publications/policy-analysis/water.pdf).

Most of Bend, Oregon's water supply comes from the Deschutes National Forest (http://www.oregonlive.com/travel/index.ssf/2013/07/deschutes_national_forests_pro.html) and the watershed eliminated cross-country travel to protect drinking water long before the travel management rule did the same for the rest of the Forest. Ashland, Oregon is also dependent on NF lands for drinking water. The Mt. Ashland ski area expansion was controversial largely because of concerns about increased sedimentation and the associated burden on their water treatment plant. I am not aware of any agreements or interactions between municipal water departments and private forest owners and managers – controlling or influencing forest roads on private lands to protect or improve drinking water. My guess is that there is likely to be an example out there.

Finally, the Washington Watershed Restoration Initiative cites the need for "expensive community water filtration systems" on their website. They may be aware of studies which provide specific evidence of linkages between forest road related sediment and drinking water challenges.

Erik Peterson
Office of Ecosystems, Tribal and Public Affairs
EPA Region 10 - Seattle
peterson.erik@epa.gov
206-553-6382

From: Kubo, Teresa
Sent: Wednesday, January 29, 2014 10:55 AM
To: Powers, David; Peterson, Erik; Leinenbach, Peter; Henning, Alan; Winiecki, Eric
Subject: RE: quick turnaround....info on forest roads and sedimentation

Hi Dave,

There is so much out there it's hard to narrow it down. I think you have most of this already, but it might be helpful to have a compilation.

In 1998, the Oregon Department of Forestry put together a Forest Road Sediment and Drainage Monitoring Project Report for
Private and State Lands in Western Oregon. In that report, they found that out of 285 miles of forest road surveyed, 31% either drained directly to streams or were likely to drain directly into streams. That report is at http://www.oregon.gov/odf/privateforests/docs/roadsediment.pdf

In 2002, ODF issued a technical report focused on BMP compliance. Sediment delivery was one area of noncompliance. The graphic below is from that report (available at http://www.oregon.gov/odf/privateforests/docs/bmpfinaltr15.pdf). Most of the sediment deliveries can be directly attributed to road crossings, road drainage design, road stream crossings , and road drainage maintenance:

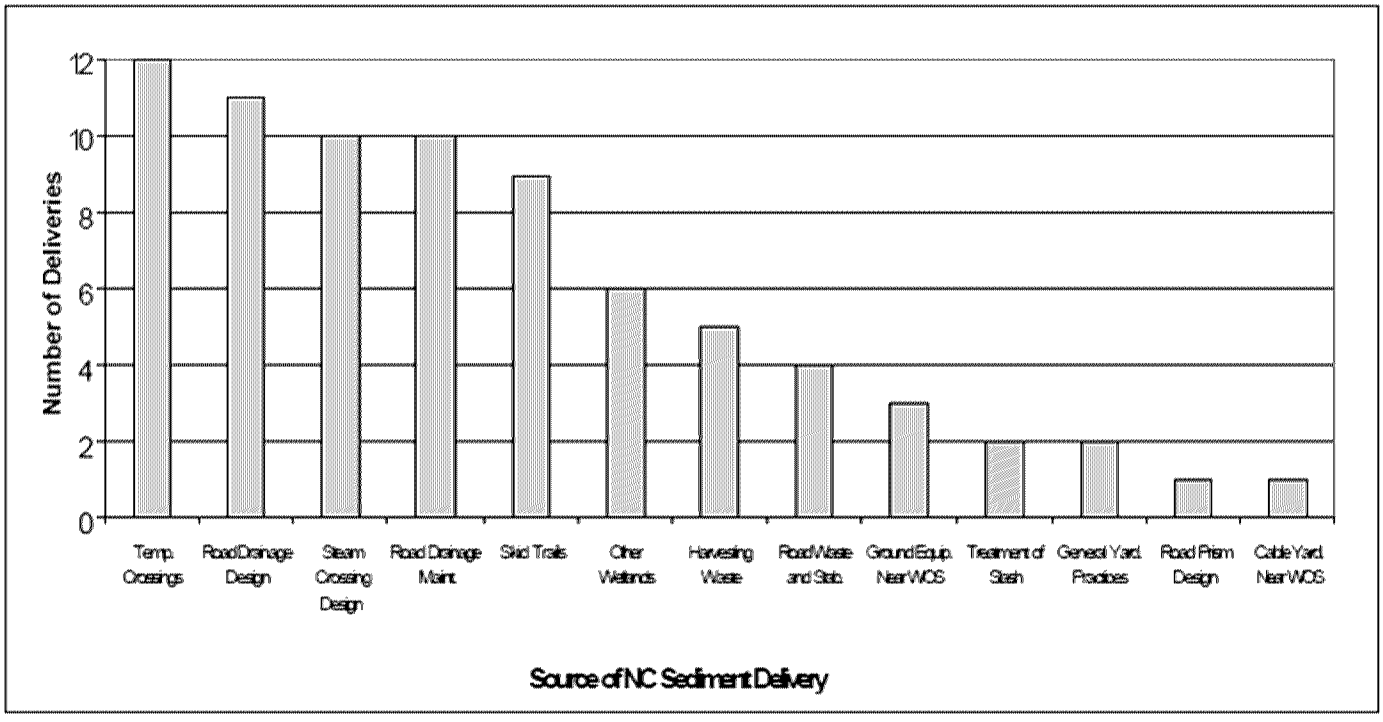

Figure 12. Distribution of Sediment Delivery Volumes from Noncompliant Practices

Really definitive work on the relationship between roads and sediment has been accomplished through the GRAIP program. They have several reports posted at http://www.fs.fed.us/GRAIP/downloads/case_studies/WatershedStudies.shtml. Here is a table from just one of the recent reports focused on the Middle Fork of the Payette (which is seriously sediment impaired). Roads in the analysis area are delivering 1,691 Mg/yr (1,864 tons/yr) of sediment to the Middle Fork Payette.

Table 1. *GRAIP modeled sediment production, sediment delivery and observed hydrologic connection by drain point type for the MFP, Idaho.*

Drain Point Type	Count	Sediment Production (Mg/yr)	Sediment Delivery (Mg/yr)	% Drain Point Delivery	% of Total Production	% of Total Delivery	Total Road length (m)	% Length	Connected Road length (m)	% connected length
Broad Based Dip	2,086	2,132	219	10%	25%	13%	155,603	17%	16,604	11%
Diffuse Drain	4,546	790	28	4%	9%	2%	314,942	34%	4,913	2%
Ditch Relief Culvert	1,869	1,509	570	38%	18%	34%	177,804	19%	64,958	37%
Lead Off Ditch	125	84	21	24%	1%	1%	9,070	1%	3,116	34%
Non-Engineered	1,712	1,358	254	19%	16%	15%	95,831	10%	19,975	21%
Stream Crossing	369	282	282	100%	3%	17%	34,884	4%	34,884	100%
Sump	127	104	-	0%	1%	0%	9,782	1%	-	0%
Water Bar	3,182	2,127	318	15%	25%	19%	140,483	15%	18,320	13%
All Drains	**14,016**	**8,388**	**1,691**	**20%**	**100%**	**100%**	**938,398**	**100%**	**162,771**	**17%**

There is a nice synthesis paper by MacDonald and Coe at http://bofdata.fire.ca.gov/regulations/proposed_rule_packages/interagency_road_rules_2010/macdonald_coe_wlf.pdf that describes road sediment and delivery (process and management)

And here is a rundown of frequently cited science related to roads/road impacts on aquatic resources and watershed function

Forest road runoff and fine sediment delivery are widely acknowledged to have serious impacts on aquatic ecosystems:

Cederholm, C. J.; Reid, L. M.;Salo, E. O. 1981. Cumulative effects of logging and road sediment on Salmonid populations in the Clearwater River, Jefferson County, Washington. In: Proceedings of the conference on salmon spawning gravel: A renewable resource in the Pacific Northwest? Pullman: Washington State University, Water Research Center: 38-74.

Platts, W. S.; Torquemada, R. J.; McHenry, M. L.; Graham, C. K. 1989. Changes in salmon spawning and rearing habitat from increased delivery of fine sediment to the South Fork Salmon River, Idaho. Transactions of the American Fisheries Society 118(3):274-283.

Thurow, R. F.; Burns, D. C. 1992. Fish response to fine sediment deposition in the Idaho Batholith. In: Sommarstrom, Sari, ed. Proceedings of the conference on decomposed granitic soils: Problems and solutions. Davis, CA: University of California, University Extension. 130 p.

Lee, D.; Sedell, J.; Rieman, B.; Thurow, R.; Williams, J.; [and others]. 1997. A broad-scale assessment of aquatic species and habitats. In: Quigley, T.; Arbelbide, S., tech. eds. An assessment of ecosystem components of the interior Columbia River Basin and portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-405. U.S. Department of Agriculture, Forest Service, Pacific Northwest

Luce, C. H.; Wemple, B. C. 2001. Introduction to the special issue on hydrologic and geomorphic effects of forest roads. Earth Surface Processes and Landforms 26:111-113.

Roads influence a variety of watershed processes, including sediment production

Megahan, W. F.; Kidd, W. J. 1972. Effects of logging roads on sediment production rates in the Idaho Batholith. Res. Pap. INT-123. Ogden UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Reid L. M. ; Dunne, T. 1984. Sediment production from forest road surfaces. Water Resources Research 20(11):1753-1761.

Bilby, R. E., Sullivan, K. O., and Duncan, S. H. 1989. The generation and fate of road surface sediment in forested watersheds in Southwestern Washington. Forest Science 35(2):453-468

Luce, C. H.; Black, T. 1999. Sediment production from forest roads in western Oregon. Water Resources Research 35(8):2561-2570.

Luce, C. H.; Black, T. 2001a. Effects of traffic and ditch maintenance on forest road sediment production. Proceedings of the seventh Federal interagency sedimentation conference; 2001 March 25-29; Reno, NV. Washington, DC: Federal Interagency Sedimentation Committee: 67-74

MacDonald, L. H.; Sampson, R. W.; Anderson, D. M. 2001. Runoff and road erosion of the plot and segment scales, St John, US Virgin Islands. Earth Surface Processes and Landforms (26):251-272.

Roads influence hydrologic event timing

Wemple, B. C., Jones, J. A., and G. E. Grant, 1996. Channel network extension by logging roads in two basins, western Cascades, Oregon. Water Resources Bulletin, 32(6):1195-1207

Jones, J. A. ; Grant, G. E. 1996. Peak flow responses to clear-cutting and road in small basin, Western Cascades, Oregon. Water Resources Research 32(4):959-974.

Roads influence slope stability

Sessions, J.; Balcom. J.; Boston, K. 1987. Road location and construction practices: Effects on landslide frequency and size in the Oregon Coast Range. Western Journal of Applied Forestry 2(4):119-124.

Montgomery, David R. 1994. Road surface drainage, channel initiation and slope instability. Water Resources Research 30(6):1925-1932.

Teresa Kubo
Environmental Review and Sediment Management
US EPA Oregon Operations
805 SW Broadway, Ste 500
Portland, Oregon 97205
Tel. 503-326-2859

From: Powers, David
Sent: Wednesday, January 29, 2014 7:55 AM
To: Kubo, Teresa; Peterson, Erik; Leinenbach, Peter; Henning, Alan; Winiecki, Eric
Subject: quick turnaround....info on forest roads and sedimentation

House and Senate versions of Farm Bill include slightly different language re: regulation of forest road runoff. EPA and I'm trying to gather info on forest road contribution to sedimentation or turbidity in watersheds and also any linkages to drinking water systems....research, TMDLs, integrated- 305b reports, public water system letters, concerns, operation/shutdown info. This is an ASAP request but will also be valuable over the longer term for EPA programs. I'm also talking to State agencies and other regions. Thanks for your help. Dave

David Powers
Regional Manager for Forests and Rangelands
USEPA, Region 10
805 SW Broadway, Suite 500
Portland, OR 97205
powers.david@epa.gov
503-326-5874